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(54) Title: MATERIAL WHICH HAS INTER ALIA HEAT RESISTING AND HEAT INSULATING PROPERTIES

(57) Abstract

A method of producing a material which displays heat insulating and heat resisting properties is disclosed, the method comprising growing Black Tea Fungus on the surface of a nutrient medium. The culture can be removed after a short growth period. In this form it is gel-like and can be used as a sun block. If allowed to grow further it forms a sheet. The sheet can be dried to a membrane-like form. Alternatively it can be mashed until it forms a gel, spread out as a layer, and then dried to form a membrane.

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MATERIAL WHICH HAS INTER ALIA HEAT RESISTING AND HEAT INSULATING PROPERTIES

FIELD OF THE INVENTION

THIS INVENTION relates to a material which has inter alia heat resisting and heat insulating properties.

BACKGROUND TO THE INVENTION

Many materials used in industry and in building are proving, after many years, to have undesirable side effects. Asbestos is an outstanding example of a material which, in the form in which it was widely used, has been shown to be a danger to health. Furthermore, many man-made materials do not bio-degrade and their disposal is a major problem. Land fill sites are becoming more difficult to find and burning such materials (eg synthetic plastics) results in atmospheric pollution.

The present invention seeks to provide a natural material which has a wide variety of uses and is environmentally friendly.

BRIEF DESCRIPTION OF THE INVENTION

According to the present invention there is provided a method of producing a material which has inter alia heat resisting and heat insulating properties which method comprises preparing a nutrient medium in which Black Tea Fungus will grow, adding a starter culture of Black Tea Fungus to the medium, and growing a layer of Black Tea Fungus

on the surface of the nutrient medium.

By "Black Tea Fungus" is meant the fungus which is also known as "mai bao", "tea treasure fungus", "tea plant" or "friendship plant".

The layer is preferably lifted from the nutrient medium when it is in the form of a sheet at least 10mm thick.

The sheet can be soaked in an additive so that the additive is absorbed into the sheet. Examples of suitable additives include medicaments, odorants, fire-retardants, anti-freeze liquids, colouring agents, and the like.

The sheet, having a thickness of about 10mm and containing said medicament absorbed therein, may be used as a medical or surgical dressing, for example, a wound or burn dressing. It not only relieves the pain but prevents clothing sticking to the burn.

The sheet, having a thickness of about 10mm and containing a liquid, eg an anti-freeze liquid absorbed therein, may be used as a heat-insulating sheet for foodstuffs. It can be used to keep the foodstuffs hot or cold.

The sheet, having a thickness of about 10mm and

containing a fire-retardant eg water, may be used as a heat or fire-protection or fire-extinguishing blanket, screen or mat. For example, said sheet may be used to extinguish a fire by placing the sheet over the fire, or in a smelting operation to screen off the smelting area, or as a liner in smelting apparatus. Said sheet may also be used to limit or extinguish fires in tunnels by moving the sheet through and against the walls of the tunnel, or as a floor-mat which is laid over a hot or burning floor to permit persons to walk over the floor. If it is in a balloon-like form, and can be inflated, it can be used to seal a tunnel eg in mining and prevent a fire spreading. The invention further contemplates the use of the sheet to cover a person trapped, for example, in a car accident, in order to protect the person against the heat should there be a fire. Also, the sheet may be used to cover metal during welding or cutting of the metal, in order to minimise the spread of heat. A further application of the sheet includes the step of beating the sheet, for example, by mashing it in a liquidiser, to form a gel-like material. This material can be sprayed on a fire to extinguish it. Said gel-like material can also be sprayed around a leaking or damaged tank containing burning liquid, in order to form a barrier to stop the burning liquid spreading. In addition, the material may be sprayed onto the underside of roof sheeting and ceilings to act as an insulator against heat and cold. It also acts to protect against fire.

By spraying a person with the gel, it is possible to provide some fire protection. Other uses of the gel are described below.

The sheet can be formed into a suitable shape and used as a mould.

The sheet can be used as separation means for example, for desalinating salt water.

Portions of the sheet, containing a suitable odorant attractive to fish absorbed therein, may be used as fish bait.

The fungus is cultured or cultivated from a pre-culture or starter-culture of the fungus in an open-topped container having a bottom wall and a peripheral side wall or side walls upstanding from the bottom wall, the side walls defining a surface area which is the desired surface area of the sheet.

The preferred nutrient medium is an aqueous extract of the tea leaves that are conventionally used for drinking (ie leaves from the plants Camellia sinensis or Thea sinensis) with a carbohydrate such as sucrose dissolved therein. Typically, the aqueous tea extract can contain, for example, 10% by weight of sucrose. Applicant has used two teaspoons of sugar per tea bag and found that this provides

an adequate nutrient medium.

The fungus is preferably cultured at room temperature eg from say 25 to 40°C, preferably about 37°C, for at least 6 days and preferably up to 15 days.

The optimum conditions and parameters under which the fungus is cultured may be determined by routine experimentation by a person skilled in the art.

The formed sheet floats on the nutrient medium and is separated from the nutrient medium as a sheet by lifting it from the container when the desired sheet thickness has been attained.

The invention extends to a sheet manufactured in accordance with the method described above.

The sheet can, after being lifted off the nutrient medium, be dried to drive off the water absorbed therein. The sheet decreases in thickness and eventually becomes a thin tough membrane which resists tearing. The sheet can be dried by placing it in direct sunlight for, say, about four days. Alternatively it can be dried at about 70 to 80 degrees Centigrade which results in it drying to its membrane form in about one hour. A sheet 10mm thick initially reduces in thickness to between 1mm and 1,5mm after having been dried as described.

Both the sheet and the membrane display resistance to attack by acids.

The invention extends to the membrane manufactured in accordance with the method described above.

The invention also contemplates the use of the membrane by immersing the membrane in a suitable liquid such as water for an appropriate time to permit the water to be re-absorbed into the membrane.

The Applicant has found that the membrane can be re-constituted into a sheet which is thicker than the membrane and containing about 90% by weight of water, by immersing the membrane in water for a period of up to about 30 minutes.

The membrane may be comminuted to form a powder, stored as a powder in a container, and when required the powder is immersed in water for about 30 minutes to form a gel-like, fire-extinguishing material.

The invention further contemplates the use of the membrane to form fire-protection clothing, for example, gloves, jackets and leggings. Thus, the membrane can be sewn to form said garments, which are immersed in water for about 10-15 minutes, prior to use as fire-protection clothing. The membrane may be reinforced, for example, by forming a multi-

layer laminate with a base material, prior to use eg in fire-protection clothing.

Applicant has found that when the gel is applied to the human body it functions both as a heat-resistant coating and as a sun block. It can thus be used to protect the human body against sunburn and fire, and to treat any burns that are received.

Further, the nutrient medium remaining after the culture has been separated therefrom may be used as a health drink.

Applicant has found experimentally that after stirring a pre-culture into the nutrient medium, the first growth can be seen as a thin film after about twenty four hours. The film steadily thickens and after forty eight hours is about 0,5mm thick. Thereafter, depending on conditions, it grows at about 0,5mm per day. During the initial growth period it is gel-like and will form a coating on any article pushed into it. As time passes it becomes harder and more rigid and eventually the layer is self supporting, that is, it can be lifted as a sheet by one edge.

It will be understood that there are restrictions on the size of the layer that can be grown because of restrictions on the size of the container that can be used.

Applicant has found that the most successful way of using the material is to beat it in any appropriate mixing apparatus until it breaks down into the form of a gel. This material can then be used in a variety of ways as will be described with reference to the examples.

DETAILED DESCRIPTION OF THE INVENTION

The invention will now be described, by way of example, with reference to the following Examples.

Example 1

An aqueous nutrient medium for culturing Black Tea Fungus was prepared in a vessel by adding hot water (1ℓ) to tea leaves (5g) in the form of two 2,5g tea bags. Sucrose (10g) in the form of refined cane sugar was added to the water so that it dissolved in the water.

The nutrient medium was allowed to cool to about 30°C and transferred into an open-topped culture dish, the dish having a bottom wall and two pairs of opposed peripheral side walls extending upwardly from the bottom wall. A pre-culture of Black Tea Fungus gel was added to the nutrient medium and the nutrient medium maintained at a temperature of about 37°C for 15 days.

A culture in the form of a flexible sheet having a

uniform thickness of 10mm was thereby cultivated or grown, floating on the surface of the culture medium. The sheet had a surface area corresponding to the surface area defined by the side walls of the culture dish.

Example 2

In small-scale tests, the sheet formed in Example 1 was used successfully as a fire screen. In the tests, a user's hand was covered by the sheet and an oxyacetylene blow torch applied for 20 seconds to the surface of the sheet remote from the user's hand. The torch did not burn the user's hand and the user did not feel the heat of the blow torch.

Example 3

In a test similar to Example 2, the sheet formed in Example 1 was shaped into a cup and the cup was held in a user's hand. Heat from molten metal in the cup did not have any effect on the user's hand.

Example 4

The sheet formed in Example 1 was formed into a cup-shape and a 20% aqueous solution of common salt was poured into the cup. After 60 minutes, less salty

water started emerging from the outside surface of the bottom of the cup.

Example 5

The sheet formed in Example 1 was dried thereby substantially eliminating its liquid content, to form a flexible coherent membrane. The membrane had a thickness of about 1,5mm. It was resistant to tearing. A possible use of this material is as a fire screen. It is flexible enough to be rolled into the form of a reel and can be unrolled when needed.

Example 6

Layers grown in accordance with Example 1 were beaten until they were reduced to the form of a gel. The gel was miscible in water and thus its viscosity could be controlled by mixing it with more or less water. The product was sprayed onto a textile substrate and then dried to form a fire resistant product. In addition it was spread as a layer about 10mm thick on a supporting surface in the form of a tray and allowed to dry. It reduced in thickness to about 1mm and formed a tough flexible membrane.

Example 7

An aqueous nutrient medium for culturing Black Tea

Fungus was prepared in a vessel by adding hot water (1ℓ) to tea leaves (5g) in the form of two 2,5g tea bags. Sucrose (10g) in the form of refined cane sugar was added to the water so that it dissolved in the water.

The nutrient medium was allowed to cool to about 30°C and transferred into an open-topped culture dish, the dish having a bottom wall and two pairs of opposed peripheral walls extending upwardly from the bottom wall. A pre-culture of Black Tea Fungus was added to the nutrient medium and the nutrient medium maintained in a germ and dirt free atmosphere at a temperature of about 37°C for three days.

A culture having a jelly-consistency was thereby cultivated or grown, floating on the surface of the nutrient medium. It was found that the culture when applied to the human body formed an effective sun block. In addition, Applicant believes that the nutrient medium remaining once the layer has been separated therefrom forms a nutritious drink.

Example 8

Membranes produced as set out in Example 6 were subjected to controlled heating by placing them in a microwave oven. The membranes tested were initially

about 1,5mm thick and, on heating for different periods, increased in thickness to a thickness of from 15mm to 30mm. The resulting products had air pockets therein and were thus of expanded cellular form. They were also flexible and could be shaped to any desired configuration before they cooled. When cooled they became stiff and took on permanently the configuration into which they had been manipulated. They were softer than the starting membrane and could be squashed by applying pressure evenly over their surfaces. This reduced their thicknesses and increased their densities.

The product had heat insulating properties and was fire resistant. Possible uses for the product include cooler boxes, linings for boxes containing electronic equipment, linings for suitcases, linings for document boxes etc, fire screens and ceiling boards.

Example 9

A gel produced as in Example 6 was mixed with 10% by weight of starch extracted from potatoes and then spread to form a sheet which was 10mm thick. The sheet, once it had dried, had shrunk by 40% in weight to form a board approximately 6mm thick. The board had fire resisting abilities. The board was thereafter powdered and added to water. It returned to a gel-like

form. This gel-like product has fire extinguishing abilities.

Example 10

Sunflower oil was mixed with water in equal proportions and with 10% by volume of gel produced as described in Example 6. The gel bound the oil and water and is thus suitable for use as an emulsifier.

Example 11

The gel made in accordance with Example 6 was mixed with powdered charcoal until a stiff paste resulted. The paste was then dried. The resultant product burned slowly and at a high temperature and can be used as a fuel.

Example 12

The gel produced in accordance with Example 6 was dehydrated by about 50% by allowing it to dry naturally and was then mixed with titanium powder until a soft mouldable paste resulted. The paste was spread to form a sheet about 8mm thick. It was sun-dried for two days and formed a rock-like sheet about 6mm thick which could not be damaged by the heat from a cutting torch. The sheet when immersed in water softened but did not

disintegrate. When dried it returned to its rock-like form. The paste can be used as a mortar or plaster in a furnace. Alternatively it can be made into a mould and used in the casting of metal objects.

Example 13

Example 12 was repeated using sand instead of titanium powder. Similar results were obtained. A limitation on the use of this material is the melting point of the sand.

Example 14

The gel formed as described in Example 6 was inserted into the spaces of a plastics board of the type known as "Correx". It was found that this imparted fire resistant properties to the board.

Example 15

A sheet produced as described in Example 1 was heated in a microwave oven. Initially the sheet became thinner and eventually became a membrane similar to that produced as described in Example 6. Further microwave heating had the effect described in Example 8.

Example 16

Gel produced as described in Example 6 was mixed with wood in the form of sawdust and wood chips until a thick paste was formed. The paste was spread out to form a layer and allowed to dry. The resultant product can be used as dry wall partitioning and the like in buildings.

The Applicant believes it is an advantage of the invention that there is provided a multi-purpose material which is environmentally friendly. The absorbent flexible sheet, the tough flexible membrane and the gel have properties which make them suitable for a large number of uses. The Applicant also believes that a further advantage is that the multi-purpose sheet can be grown on an industrial scale at a relatively low cost and thereafter turned into a membrane by heating or used in a variety of other ways.

CLAIMS

1. A method of producing a material which has inter alia heat resisting and heat insulating properties which method comprises preparing a nutrient medium in which Black Tea Fungus will grow, adding a starter culture of Black Tea Fungus to the medium, and growing a layer of Black Tea Fungus on the surface of the nutrient medium.

2. A method as claimed in claim 1, wherein the nutrient medium is an infusion of tea leaves.

3. A method as claimed in claim 1, in which the nutrient medium is maintained at a temperature of between 25 and 40 degrees centigrade for a period of not less than 6 days to grow the layer.

4. A method as claimed in claim 3, wherein the nutrient medium is maintained at a temperature of 37 degrees centigrade.

5. A method as claimed in claim 1, wherein the layer is removed from the nutrient medium once it has grown to the form of a self supporting sheet.

6. A method as claimed in claim 5, wherein the sheet is removed when it has attained a thickness of about 10mm.

7. A method as claimed in claim 5, wherein the sheet after removal from the nutrient medium is dried thereby to reduce its thickness and produce a membrane which is thinner than the sheet.

8. A method as claimed in claim 5, and including the step of beating the sheet so that it is reduced to the form of a gel.

9. A method as claimed in claim 8, and including the further step of mixing the gel with water to form a fire extinguishing medium.

10. A method as claimed in claim 8, and including the further step of spreading the gel as

a layer over a supporting surface and drying the layer to form a membrane.

11. A method as claimed in claim 5, and further comprising the step of heating said sheet in a microwave oven after it has been removed from the nutrient medium.

12. A method as claimed in claim 5, and which includes impregnating the sheet with an additive which modifies its properties by soaking the sheet in a liquid medium which contains the additive.

13. A method of desalinating water which comprises causing salt bearing water to flow through a sheet produced in accordance with the method claimed in claim 5.

14. A method as claimed in claim 1, wherein the nutrient medium is maintained at a temperature of between 25 and 40 degrees centigrade in a germ and dirt free atmosphere for a period of two to three days to produce a gel-like culture which can be used for the treatment and protection of the human body.

15. A method of producing a fire resistant coating on an article which comprises dipping the article into the gel produced in accordance with the method of claim 8.

16. A method of producing a fire resistant coating on an article which comprises spraying onto the article the gel produced in accordance with the method of claim 8.

17. A method as claimed in claim 8, and which includes a further step of mixing the gel with a particulate material to form a paste, and allowing the paste to dry.

18. A method as claimed in claim 17, wherein the particular material is titanium or sand.

19. A method as claimed in claim 8, and

further including the step of mixing the gel with wood in the form of sawdust to form a paste and allowing the paste to dry.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) :C12P 1/00, 39/00; C12N 9/14, 1/38, 13/00; A01N 63/00; A61K 35/00
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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, CAS ONLINE, DIALOG, MEDLINE, WPIDS, JPOABS, BIOSIS
searcg terms: black tea fungus, tea fungus, mat, sheet?, membrane?, fire extenguish?

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3,719,513 (BRAGG ET AL.) 06 March 1973, column 1, lines 50-65.	9-12 and 15-19
Y	US 3,669,879 (BERRIMAN) 13 June 1972, column 5, lines 35-70.	12-13
Y	JANKOVIC et al. Microbial and Chemical Composition, Growth, Therapeutical and Antimicrobial Characteristics of Tea Fungus. Mikrobiologija. 1994. Vol. 31, No. 1, pages 35-43, especially page 36.	1-19
Y	REISS, J. Influence of different sugars on the metabolism of the Tea Fungus. Zeitschrift fuer Lensmittel-Untersuchung und Forschung. 1994. Volume 198, No. 3, pages 285-261, especially page 259.	1-19

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INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FONTANA et al. Nature of Plant Stimulators in the Production of Acetobacter xylinum ("Tea fungus:) Biofilm Used in Skin Therapy. Applied Biochemistry and Biotechnology. 1991. Volume 28/29, pages 341-351, especially pages 349-350.	1-19

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